Chapter 6 • Quiz 1 — Form A

Name _____ Period _____ Date _____

1. In 2000, Open Road Bus Lines charged \$125.00 for a ticket from Chicago to Phoenix. Since then, the price of the ticket has increased by 3% per year. Let x represent the number of years since 2000, and let y represent the ticket price.

a. Use this recursive routine to complete the table.

{0, 125} ENTER
{Ans(1) + 1, Ans(2) · (1 + 0.03)} ENTER

Year	Years since 2000, x	Ticket price, y (\$)
2000		
2001		
2002		
2003		
2004		
2005		

b. What is the constant multiplier for the y-values?

c. Write an equation for calculating the ticket price for any year after 2000.

d. In what year will the ticket price first exceed \$160.00?

2. A box of cereal costs \$4.98. Because of inflation, the price increases by 4% per year.

a. Write an equation to model the growth in the price of the cereal.

b. Use your equation from 2a to predict the price of the cereal three years from now.

c. Use your equation from 2a to predict when the price will first exceed \$7.50.

Chapter 6 • Quiz 1 — Form B

Name _____ Period _____ Date _____

1. In 2000, Open Road Bus Lines charged $115.00 for a ticket from Denver to San Francisco. Since then, the price of the ticket has increased by 4% per year. Let x represent the number of years since 2000, and let y represent the ticket price.

Year	Years since 2000, x	Ticket price, y ($)
2000		
2001		
2002		
2003		
2004		
2005		

a. Use this recursive routine to complete the table.

{0, 115} ENTER
{Ans(1) + 1, Ans(2) · (1 + 0.04)} ENTER

b. What is the constant multiplier for the y-values?

c. Write an equation for calculating the ticket price for any year after 2000.

d. In what year will the ticket price first exceed $170.00?

2. A box of cereal costs $4.50. Because of inflation, the price increases by 6% per year.

a. Write an equation to model the growth in the price of the cereal.

b. Use your equation from 2a to predict the price of the cereal three years from now.

c. Use your equation from 2a to predict when the price will first exceed $6.50.

Chapter 6 • Quiz 2 — Form A

Name _____ Period _____ Date _____

1. Use the properties of exponents to write each expression in the form ax^n.

a. $4x^6 \cdot 2x^6$ **b.** $(-5x^3) \cdot (-2x^4)$ **c.** $\frac{72x^7}{6x^2}$ **d.** $(2x)(-4x)(-4x)$

e. $\frac{6x^5}{3x}$ **f.** $3(2x)^2$

2. Write each number in standard notation.

a. -2.4×10^4 **b.** 3.25×10^{-5} **c.** -5.5×10^{-3}

3. Write each number in scientific notation.

a. 37,140,000 **b.** 0.000801 **c.** -0.00001

4. Write each expression using only positive exponents.

a. $2 \cdot x^{-1}$ **b.** $(2x)^{-1}$ **c.** $\frac{1}{4^{-5}}$ **d.** $\frac{x^{-2}}{y^{-5}}$

5. Use the properties of exponents to rewrite each expression.

a. $\frac{7.6x^7}{3.8x^3}$ **b.** $x^2 \cdot (-2)^0$ **c.** $x^4 \cdot x^6$ **d.** $3^4 \cdot 2^2 \cdot 3^2 \cdot 2^3$

e. $\frac{(-2y)^4}{(-2y)^3}$ **f.** $(3x^2y)^2(-5xy)$ **g.** $\frac{8 \times 10^9}{4 \times 10^6}$ **h.** $4(2x)^{-2}(x^2y)$

6. Tell whether each equation is true or false. If it is false, change the right side to make the equation true.

a. $(3x^2)^3 = 9x^6$ **b.** $3(2x^2)^{-1} = -6x^{-2}$

7. Uranus is about 2.87×10^{12} m from the Sun. Light travels at approximately 3×10^8 m/s. How long does it take for the Sun's light to reach Saturn? Give your answer in seconds and to the nearest minute.

Chapter 6 • Quiz 2 — Form B

Name _____ Period _____ Date _____

1. Use the properties of exponents to write each expression in the form ax^n.

a. $3x^5 \cdot 2x^5$ **b.** $\left(-7x^2\right) \cdot \left(-4x^5\right)$ **c.** $\frac{56x^9}{8x^2}$ **d.** $(3x)(-5x)(-5x)$

e. $\frac{14x^3}{2x}$ **f.** $2(3x)^3$

2. Write each number in standard notation.

a. -3.2×10^3 **b.** 4.89×10^{-4} **c.** -7.01×10^{-5}

3. Write each number in scientific notation.

a. 5,814,000 **b.** 0.00722 **c.** -0.00004

4. Write each expression using only positive exponents.

a. $3 \cdot x^{-2}$ **b.** $(3x)^{-1}$ **c.** $\frac{1}{7^{-3}}$ **d.** $\frac{y^{-4}}{x^{-2}}$

5. Use the properties of exponents to rewrite each expression.

a. $\frac{4.5x^6}{0.5x^2}$ **b.** $(-21)^0 \cdot x^5$ **c.** $x^5 \cdot x^7$ **d.** $5^4 \cdot 7^2 \cdot 5 \cdot 7^5$

e. $\frac{\left(3y^2\right)^6}{\left(3y^2\right)^5}$ **f.** $\left(-4xy^2\right)^2\left(3x^2y\right)$ **g.** $\frac{9 \times 10^9}{1.5 \times 10^5}$ **h.** $9(3x)^{-2}\left(2x^2y\right)$

6. Tell whether each equation is true or false. If it is false, change the right side to make the equation true.

a. $\left(2x^3\right)^3 = 6x^6$ **b.** $2\left(3x^3\right)^{-1} = -6x^{-2}$

7. Saturn is about 1.427×10^{12} m from the Sun. Light travels at approximately 3×10^8 m/s. How long does it take for the Sun's light to reach Saturn? Give your answer in seconds and to the nearest minute.

Name _____ Period _____ Date _____

1. During the radioactive decay investigation, one group used the equation $y = 200(1 - 0.18)^x$ to model their data.

a. Use the equation to complete this table.

Years, x	Atoms remaining, y
0	
1	
2	
3	
4	
5	
6	

b. Explain what the numbers 200 and 0.18 in the equation represent in this situation.

2. Write an equation for the relationship between x and y given in the table. Then use your equation to complete the table.

x	y
−2	
−1	
0	64
1	12.8
2	2.56
3	0.512
4	

Chapter 6 • Quiz 3 — Form B

Name _____ **Period** _____ **Date** _____

1. During the radioactive decay investigation, one group used the equation $y = 150(1 - 0.16)^x$ to model their data.

a. Use the equation to complete this table.

Years, x	Atoms remaining, y
0	
1	
2	
3	
4	
5	
6	

b. Explain what the numbers 150 and 0.16 in the equation represent in this situation.

2. Write an equation for the relationship between x and y given in the table. Then use your equation to complete the table.

x	y
−2	
−1	
0	1000
1	700
2	490
3	343
4	

Name _____ Period _____ Date _____

1. Use the properties of exponents to rewrite each expression.

a. $24x^5 \cdot 2x^2$ **b.** $\left(5x^3y^2\right)^2$ **c.** $\frac{72x^6}{3x}$

d. $5^x5^y3^z$ **e.** $\frac{1.4 \times 10^{14}}{2.8 \times 10^{16}}$ **f.** $\left(3x^7y^3\right)\left(-12x^4y\right)$

2. A rubber ball rebounds to 85% of the height from which it is dropped.

a. How high is the first bounce if the ball is dropped from a height of 200 cm?

b. Record the height of each bounce in the table.

c. Write a recursive routine that generates the heights of the bounces.

d. Write an equation that generates the heights of the bounces.

e. On which bounce will the height first be less than 70 cm?

Bounce number	Height (cm)
0	200
1	
2	
3	
4	
5	

3. Write each number in standard notation.

a. -4.3×10^5 **b.** 5.25×10^{-4}

4. Write each number in scientific notation.

a. 31,540,000,000 **b.** -0.00000502

5. Find the x-value that makes each equation true.

a. $0.000712 = 7.12 \times 10^x$ **b.** $25 \times 10^{-5} = 2.5 \times 10^x$ **c.** $0.0047 = 4.7 \times 10^x$

6. Use the properties of exponents to answer each question.

a. Explain why $\frac{8^5}{8^5} = 1$. **b.** Write an equation equivalent to $y = \frac{1}{10^x}$.

7. Assume that the values of paintings by a certain artist increase by 7% each year. For each question, write an expression in the form $A(1 + r)^x$. Then evaluate the expression to answer the question.

a. If a painting is worth \$5,000 today, how much was it worth three years ago?

b. If a painting was worth \$3,000 two years ago, how much is it worth today?

c. If a painting is worth \$2,000 today, how much will it be worth in 40 years?

8. What are the advantages of using scientific notation to express very large and very small numbers?

Chapter 6 • Test — Form B

Name _____ Period _____ Date _____

1. Use the properties of exponents to rewrite each expression.

a. $12x^3 \cdot 3x^5$ **b.** $\left(7x^2y^3\right)^3$ **c.** $\frac{45x^6}{3x^2}$

d. $7^x5^y7^z$ **e.** $\frac{1.2 \times 10^8}{4.8 \times 10^{12}}$ **f.** $\left(5x^4y\right)\left(-6x^3y^5\right)$

2. A rubber ball rebounds to 75% of the height from which it is dropped.

a. How high is the first bounce if the ball is dropped from a height of 300 cm?

b. Record the height of each bounce in the table.

c. Write a recursive routine that generates the heights of the bounces.

d. Write an equation that generates the heights of the bounces.

e. On which bounce will the height first be less than 20 cm?

Bounce number	Height (cm)
0	300
1	
2	
3	
4	
5	

3. Write each number in standard notation.

a. 2.8×10^7 **b.** 4.3×10^{-3}

4. Write each number in scientific notation.

a. 781,000,000 **b.** -0.0000533

5. Find the x-value that makes each equation true.

a. $0.00624 = 6.24 \times 10^x$ **b.** $377 \times 10^{-3} = 3.77 \times 10^x$ **c.** $0.00074 = 7.4 \times 10^x$

6. Use the properties of exponents to answer each question.

a. Explain why $\frac{6^{-3}}{6^{-3}} = 1$. **b.** Write an equation equivalent to $y = 5^{-x}$.

7. Assume that the values of houses in a particular neighborhood increase by 8% each year. For each question, write an expression in the form $A(1 + r)^x$. Then evaluate the expression to answer the question.

a. If a house is worth \$200,000 today, how much was it worth four years ago?

b. If a house was worth \$175,000 three years ago, how much is it worth today?

c. If a house is worth \$300,000 today, how much will it be worth in ten years?

8. What are the advantages of using scientific notation to express very large and very small numbers?

Chapter 6 • Constructive Assessment Options

Choose one or more of these items to replace part of the chapter test. Let students know that they will receive from 0 to 5 points for each item depending on the correctness and completeness of their answer.

1. *(Lessons 6.1, 6.2)*
Divide the tables, recursive routines, and equations into groups so the items in each group represent the same relationship. Show all your work and explain how you found your answers.

a.

x	y
0	2
1	4
2	8
3	16
4	32

b.

x	y
0	16
1	8
2	4
3	2
4	1

c.

x	y
0	16
1	4
2	1
3	0.25
4	0.0625

d.

x	y
0	2
1	1
2	0.5
3	0.25
4	0.125

e. {0, 2} ENTER
{Ans(1) + 1, Ans(2) · (1 + 0.5)} ENTER, ENTER, . . .

f. {0, 16} ENTER
{Ans(1) + 1, Ans(2) · (1 − 0.75)} ENTER, ENTER, . . .

g. {0, 2} ENTER
{Ans(1) + 1, Ans(2) · (1 − 0.5)} ENTER, ENTER, . . .

h. {0, 16} ENTER
{Ans(1) + 1, Ans(2) · (1 − 0.25)} ENTER, ENTER, . . .

i. $y = 16(1 - 0.25)^x$

j. $y = 2(1 + 1)^x$

k. $y = 2(1 + 0.5)^x$

l. $y = 2(1 - 0.5)^x$

2. *(Lesson 6.2)*
Do the following for parts a and b:

i. Describe a real-world exponential growth or decay situation that fits the conditions.

ii. Write an equation for the situation, explaining what each variable in the equation represents.

iii. Write a question about your situation that can be answered by using your equation, and give the answer.

a. The starting value is 12, and the growth rate is 10%.

b. The value after two time periods is 20, and the value after three time periods is 18.

(continued)

3. *(Lessons 6.2, 6.6)*
A bus company raises the prices of its tickets by 3.4% per year. In 2005, the price of a ticket from Dallas to New Orleans was $80.00.

a. Write an equation that can be used to calculate the price of a ticket from Dallas to New Orleans for any year. Use y to represent the price of the ticket, and use x to represent the number of years after 2005.

b. Write two questions about the ticket price that can be answered by using your equation. Answering one question should require substituting a positive value for x, and answering the other question should require substituting a negative value for x. Give the answers and show how you found them.

4. *(Lesson 6.3)*
As part of her homework assignment, Kristi had to use the properties of exponents to rewrite expressions. She made mistakes on these three problems. For each problem, describe what Kristi did wrong and give the correct answer.

a. $(x^3y^4)^2 = x^5y^6$ **b.** $(3x^2)(5x^7) = 8x^9$ **c.** $(x^4)^3(x^7) = x^{14}$

5. *(Lesson 6.6)*
Kelly was absent when her class learned about zero and negative exponents. Write a note to Kelly explaining what she needs to know about zero and negative exponents. Include examples to help her understand why the meanings of zero and negative exponents make sense.

6. *(Lesson 6.7)*
The table shows the number of people in the world per automobile at five-year intervals starting in 1950.

a. Write an exponential equation to model the data. Show all your work.

b. In a scatter plot of the data, what does the point (10, 31.0) represent?

c. Based on the data, what conclusion can you draw about how the number of automobiles is changing relative to the world population? Explain how you arrived at your conclusion.

d. What do you think the trend in the number of people per automobile will be for the next 50 years? Use the data to support your answer.

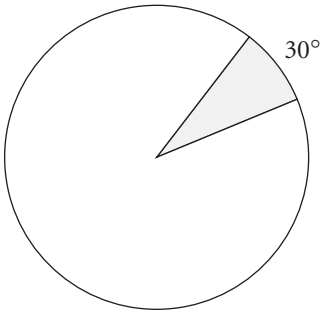
Years after 1950, x	People per automobile, y
0	48.2
5	38.1
10	31.0
15	23.9
20	19.1
25	15.7
30	13.9
35	12.9
40	11.9
45	11.7

(Brown, Flavin, and Renner, *Vital Signs 1997*, Worldwatch Institute, 1997, pp. 75 and 81)

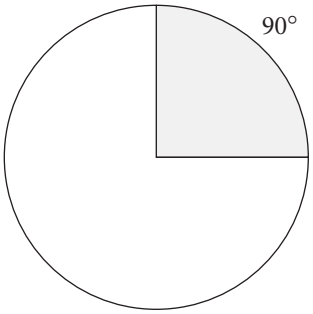
(continued)

7. *(Lesson 6.7)*
Shown are the paper plates the groups in Mr. Stein's class will be using for the Radioactive Decay investigation. Each group will start the activity with 100 counters. For each plate, sketch a graph and write an equation to approximate the results the group can expect to get. (Let x represent the number of years, and let y represent the number of atoms remaining.) Sketch all the graphs on the same set of axes.

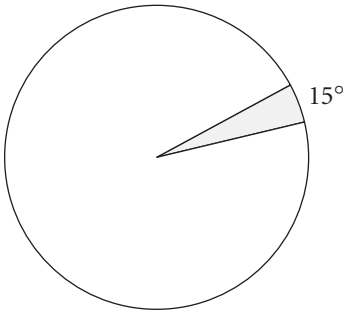
a.



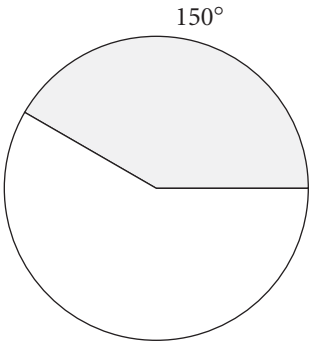
b.



c.



d.



8. *(Lesson 6.8)*
A ball is dropped and allowed to bounce until it stops. The equation $y = 1.8(1 - 0.23)^x$ gives the height of the ball in meters after x bounces.

a. What does the number 1.8 in the equation represent in this situation?

b. What does the number 0.23 in the equation represent in this situation?

c. If some of the air is let out of the ball and it is dropped from a greater height, how will the numbers in the equation change? Explain your answer.

d. If air is added to the ball and it is dropped from a lesser height, how will the numbers in the equation change? Explain your answer.

combinations but forgets one or lists one twice), but the explanation is clear and logical.

d. The answer is correct, but the explanation is unclear, or the answer is incorrect due to minor errors, but the explanation is clear and logical.

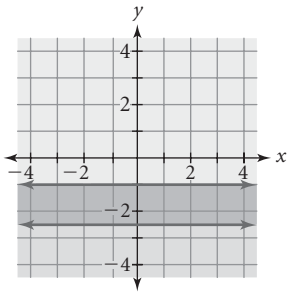
1 Point
The system and graph are mostly correct. Parts c and d are missing or incorrect.

8. 5 Points
Systems satisfy the conditions, and graphs and solutions are correct.

a. Sample answer:

$$\begin{cases} y \leq -1 \\ y \geq -2.5 \end{cases}$$

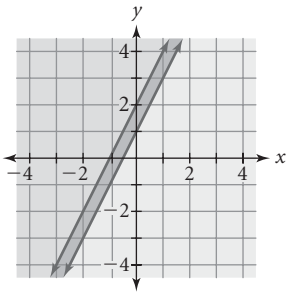
The region of overlap is the solution.



b. Sample answer:

$$\begin{cases} y \leq 2x + 2 \\ y \geq 2x + 1 \end{cases}$$

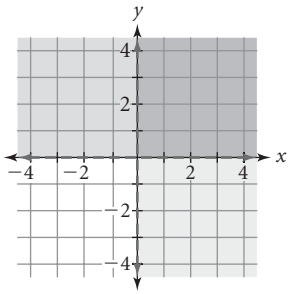
The region of overlap is the solution.



c. Sample answer:

$$\begin{cases} x > 0 \\ y > 0 \end{cases}$$

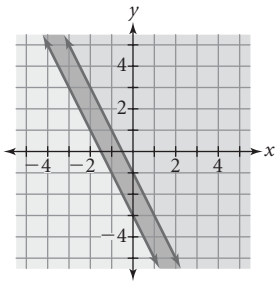
The region of overlap is the solution.



d. Sample answer:

$$\begin{cases} y \leq -2x - 1 \\ y \geq -2x - 3 \end{cases}$$

The region of overlap is the solution.



3 Points
Three answers are correct.

1 Point
Only one answer is correct.

CHAPTER 6 • Quiz 1 — Form A

1. a.

Year	Years since 2000, x	Ticket price, y ($)
2000	0	125.00
2001	1	128.75
2002	2	132.61
2003	3	136.59
2004	4	140.69
2005	5	144.91

b. 1.03 **c.** $y = 125(1 + 0.03)^x$

d. Year 9, or 2009

2. a. $y = 4.98(1 + 0.04)^x$, where x is the number of years from now and y is the price of the cereal

b. $5.60 **c.** 11 years from now

CHAPTER 6 • Quiz 1 — Form B

1. a.

Year	Years since 2000, x	Ticket price, y ($)
2000	0	115.00
2001	1	119.60
2002	2	124.38
2003	3	129.36
2004	4	134.53
2005	5	139.92

b. 1.04 **c.** $y = 115(1 + 0.04)^x$

d. Year 10, or 2010

2. a. $y = 4.50(1 + 0.06)^x$, where x is the number of years from now and y is the price of the cereal

b. \$5.36 **c.** Seven years from now

CHAPTER 6 • Quiz 2 — Form A

1. a. $8x^{12}$ **b.** $10x^7$ **c.** $12x^5$
d. $32x^3$ **e.** $2x^4$ **f.** $12x^2$

2. a. $-24{,}000$ **b.** 0.0000325 **c.** -0.0055

3. a. 3.714×10^7 **b.** 8.01×10^{-4}
c. -1×10^{-5}

4. a. $\frac{2}{x}$ **b.** $\frac{1}{2x}$ **c.** 4^5 **d.** $\frac{y^5}{x^2}$

5. a. $2x^4$ **b.** x^2 **c.** x^{10} **d.** $3^6 2^5$
e. $-2y$ **f.** $-45x^5y^3$ **g.** 2×10^3 **h.** y

6. a. False; $(3x^2)^3 = 27x^6$
b. False; possible answer: $3(2x^2)^{-1} = \frac{3}{2}x^{-2}$

7. About 9567 s, or about 159 min

CHAPTER 6 • Quiz 2 — Form B

1. a. $6x^{10}$ **b.** $28x^7$ **c.** $7x^7$
d. $75x^3$ **e.** $7x^2$ **f.** $54x^3$

2. a. -3200 **b.** 0.000489 **c.** -0.0000701

3. a. 5.814×10^6 **b.** 7.22×10^{-3}
c. 4×10^{-5}

4. a. $\frac{3}{x^2}$ **b.** $\frac{1}{3x}$ **c.** 7^3 **d.** $\frac{x^2}{y^4}$

5. a. $9x^4$ **b.** x^5 **c.** x^{12} **d.** $5^5 7^7$
e. $3y^2$ **f.** $48x^4y^5$ **g.** 6×10^4 **h.** $2y$

6. a. False; $(2x^3)^3 = 8x^9$
b. False; possible answer: $2(3x^3)^{-1} = \frac{2}{3}x^{-3}$

7. About 4757 s, or about 79 min

CHAPTER 6 • Quiz 3 — Form A

1. a.

Years, x	Atoms remaining, y
0	200
1	164
2	134
3	110
4	90
5	74
6	61

b. 200 represents the original number of "atoms" (i.e., counters), and 0.18 is the rate of decay.

2. $y = 64(1 - 0.8)^x$, or $y = 64(0.2)^x$

x	-2	-1	0	1	2	3	4
y	1600	320	64	12.8	2.56	0.512	0.1024

CHAPTER 6 • Quiz 3 — Form B

1. a.

Years, x	Atoms remaining, y
0	150
1	126
2	106
3	89
4	75
5	63
6	53

b. 150 represents the original number of "atoms" (i.e., counters), and 0.16 is the rate of decay.

2. $y = 1000(1 - 0.3)^x$, or $y = 1000(0.7)^x$

x	-2	-1	0	1	2	3	4
y	2040.8	1428.6	1000	700	490	343	240.1

CHAPTER 6 • Test — Form A

1. a. $48x^7$ **b.** $25x^6y^4$
c. $24x^5$ **d.** $5^{x+y}3^z$
e. 0.5×10^{-2}, or 5×10^{-3}
f. $-36x^{11}y^4$

2. a. 170 cm

b.

Bounce number	Height (cm)
0	200
1	170
2	144.5
3	122.8
4	104.4
5	88.7

c. {0, 200} ENTER, {Ans(1) + 1, Ans(2) · (1 − 0.15)} ENTER, ENTER, . . . (Note: The rule {Ans(1) + 1, Ans(2) · 0.85} is also correct.)

d. $y = 200(1 - 0.15)^x$, or $y = 200(0.85)^x$

e. Bounce 7

3. a. $-430{,}000$ **b.** 0.000525

4. a. 3.154×10^{10} **b.** -5.02×10^{-6}

5. a. -4 **b.** -4 **c.** -3

6. a. $\frac{8^5}{8^5} = 8^{5-5} = 8^0 = 1$ **b.** $y = 10^{-x}$

7. a. $5{,}000(1 + 0.07)^{-3}$; \$4,081.49

b. $3{,}000(1 + 0.07)^2$; \$3,434.70

c. $2{,}000(1 + 0.07)^{40}$; \$29,948.92

8. Answers will vary. Students should indicate that using scientific notation makes very large and very small numbers easier to write and to use in calculations.

CHAPTER 6 • Test — Form B

1. a. $36x^8$ **b.** $7^3x^6y^9$, or $343x^6y^9$ **c.** $15x^4$

d. $7^{x+z}5^y$ **e.** 0.25×10^{-4}, or 2.5×10^{-5}

f. $-30x^7y^6$

2. a. 225 cm

b.

Bounce number	Height (cm)
0	300
1	225
2	168.8
3	126.6
4	94.9
5	71.2

c. {0, 300} ENTER, {Ans(1) + 1, Ans(2) • (1 − 0.25)} ENTER, ENTER, . . . (Note: The rule {Ans(1) + 1, Ans(2) • 0.75} is also correct.)

d. $y = 300(1 - 0.25)^x$, or $y = 300(0.75)^x$

e. Bounce 10

3. a. 28,000,000 **b.** 0.0043

4. a. 7.81×10^8 **b.** -5.33×10^{-5}

5. a. −3 **b.** −1 **c.** −4

6. a. $\frac{6^{-3}}{6^{-3}} = 6^{-3-(-3)} = 6^{-3+3} = 6^0 = 1$

b. $y = \frac{1}{5^x}$

7. a. $200{,}000(1 + 0.08)^{-4}$; \$147,006

b. $175{,}000(1 + 0.08)^3$; \$220,450

c. $300{,}000(1 + 0.08)^{10}$; \$647,677

8. Answers will vary. Students should indicate that using scientific notation makes very large and very small numbers easier to write and to use in calculations.

CHAPTER 6 • Constructive Assessment Options

Scoring Rubrics

1. 5 Points

All the items are grouped correctly, work is shown, and a correct explanation is given. The groups are {a, j}, {b}, {c, f}, {d, g, l}, {e, k}, and {h, i}. Sample explanation: First I wrote equations for parts a–h. Then I grouped the items with matching equations.

a. $y = 2(1 + 1)^x$ **b.** $y = 16(1 - 0.5)^x$

c. $y = 16(1 - 0.75)^x$ **d.** $y = 2(1 - 0.5)^x$

e. $y = 2(1 + 0.5)^x$ **f.** $y = 16(1 - 0.75)^x$

g. $y = 2(1 - 0.5)^x$ **h.** $y = 16(1 - 0.25)^x$

i. $y = 16(1 - 0.25)^x$ **j.** $y = 2(1 + 1)^x$

k. $y = 2(1 + 0.5)^x$ **l.** $y = 2(1 - 0.5)^x$

3 Points

Two or three items are grouped incorrectly. Work is shown and an explanation is given, but the explanation is somewhat vague. Sample explanation: I looked at how y changed and matched things that changed the same way.

1 Point

Only a few items are matched correctly. Some work is shown, but the explanation is unclear or missing.

2. 5 Points

Situations fit the conditions. Equations are correct. Questions are clear and answers are correct.

a. i. Sample situation: A baseball card is worth \$12, and each year its value appreciates by 10%.

ii. $y = 12(1 + 0.1)^x$, or $y = 12(1.1)^x$, where y is the value of the card and x is the number of years.

iii. Sample question and answer based on the situation in part i:

Q: What will the card be worth in five years?
A: \$19.33

b. i. Sample situation: A car was worth \$20 thousand when it was two years old and \$18 thousand when it was three years old.

ii. $y = 24.69(1 - 0.1)^x$, or $y = 24.69(0.9)^x$, where y is the value of the car in thousands of dollars and x is the number of years.

iii. Sample question and answer based on the situation in part i:

Q: How much will the car be worth ten years after it was purchased?
A: \$8.6 thousand

3 Points

a. Answers to all three parts are correct or have very minor errors.

b. The situation meets the conditions. The decay rate in the equation is correct, but the starting value may be incorrect. The question is clear and appropriate, but the answer may be incorrect due to an incorrect equation.

1 Point

Most of the answers are attempted, with work shown, but many of the answers are incorrect.

3. 5 Points

a. $y = 80(1 + 0.034)^x$, or $y = 80(1.034)^x$

b. Questions are clear and fit the given requirements. Answers are correct, and work is shown. Sample questions and answers:

Q: How much did the ticket cost in 1995?
A: Substitute -10 for x:
$y = 80(1 + 0.034)^{-10} \approx 57.26$. The ticket cost \$57.26 in 1995.

Q: How much will the ticket cost in 2030?
A: Substitute 25 for x:
$y = 80(1 + 0.034)^{25} \approx 184.55$. The ticket will cost \$184.55 in 2030.

3 Points

a. The equation is correct.

b. Questions are clear and are answered correctly, but one of the requirements is not met (e.g., both questions involve positive exponents), or questions are clear and meet the requirements, but answers are incorrect or incomplete.

1 Point

a. The equation has x as an exponent but is not correct. Sample answer: $y = 80(0.34)^x$.

b. Questions are attempted, but they are not clear or do not fit the requirements. Answers are incorrect or missing.

4. 5 Points

Kristi's mistakes are explained, and correct solutions are given.

a. She added 2 to each exponent inside the parentheses. She should have multiplied each exponent by 2. The correct answer is x^6y^8.

b. She added the coefficients 3 and 5. She should have multiplied them. The correct answer is $15x^9$.

c. She added all the exponents. She should first have found $(x^4)^3$, which requires multiplying the exponents to get x^{12}. Then she should have found $x^{12} \cdot x^7$, which requires adding the exponents to get x^{19}. The correct answer is x^{19}.

3 Points

Two answers are correct. The other answer is attempted but is not completely correct.

1 Point

Only one answer is correct.

5. 5 Points

The answer includes the following points:

- A statement that any number, except 0, raised to the zero power is 1 (that is, $b^0 = 1$ for $b \neq 0$)
- An example showing why the previous statement makes sense; for example,

  $\frac{2^4}{2^4} = 2^{4-4} = 2^0$, and $\frac{2^4}{2^4} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{2}} = 1$,

  so $2^0 = 1$
- A statement that any number, except 0, raised to a negative power is equal to 1 over that number raised to the opposite power (that is, $b^{-n} = \frac{1}{b^n}$ for $b \neq 0$)
- An example showing why the previous statement makes sense; for example,

  $\frac{3^2}{3^5} = 3^{2-5} = 3^{-3}$, and $\frac{3^2}{3^5} = \frac{\cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot 3 \cdot 3 \cdot 3} = \frac{1}{3^3}$,

  so $3^{-3} = \frac{1}{3^3}$

3 Points

The answer includes the items listed, but minor details are missing or incorrect. (For example, the answer may not mention that the number raised to a zero or negative power cannot be 0.)

1 Point

The answer mentions that a number raised to the zero power is 1 and a number raised to a negative power is 1 over the number to the opposite power, but examples are missing or incorrect.

6. 5 Points

a. Equations will vary but should fit the data reasonably well. Sample equation: $y = 48.2(0.955)^x$. In this equation, 48.2 is the starting value (the value for 1950) and 0.955 was found by guessing and checking.

b. In 1960, there were 31 people per automobile.

c. Because the ratio of people to automobiles is decreasing, the number of cars is growing at a faster rate than the population.

d. Predictions will vary but should be supported by the data. Sample response: The table shows that the number of people per automobile has been leveling off. I predict that this trend will continue, with the number leveling off somewhere near 10.

3 Points

a. The equation fits the data reasonably well.

b. In 1960, there were 31 people per vehicle.

c. The answer is unclear or incomplete. Sample answer: The number of cars is increasing.

d. The prediction is reasonable, but the explanation is missing or unclear, or is not supported by the data. Sample answer: The number of people per car will not get much lower.

1 Point

Answers are attempted, but only one or two are correct. Explanations are inadequate or incorrect.

7. 5 Points

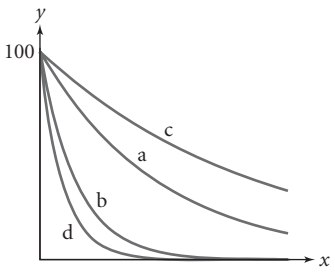
The equations have starting values of 100 and decay rates close to those in the equations shown here. The relative shapes and positions of the curves are the same as those shown.

a. $y = 100(1 - 0.083)^x$

b. $y = 100(1 - 0.25)^x$

c. $y = 100(1 - 0.0417)^x$

d. $y = 100(1 - 0.417)^x$



3 Points

One of the equations is incorrect. One of the graphs is incorrect.

1 Point

The equations are all exponential equations, but the graphs and equations are mostly incorrect.

8. 5 Points

Answers are correct, and explanations in parts c and d are clear.

a. 1.8 is the height from which the ball is dropped.

b. The height of the ball decreases by 23% with each bounce.

c. The starting value, 1.8, would increase, because the starting height is greater. The decay rate, 0.23, would increase because the ball would not be as bouncy and its height would decrease by a greater percentage with each bounce.

d. The starting value, 1.8, would decrease, because the starting height is less. The decay rate, 0.23, would decrease because the ball would be bouncier and its height would decrease by a smaller percentage with each bounce.

3 Points

One answer is incorrect. One explanation is inadequate or incorrect.

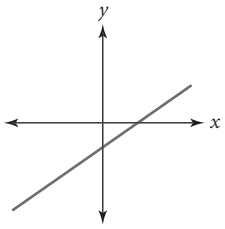
1 Point

Only one answer is correct. Explanations are missing or are inadequate.

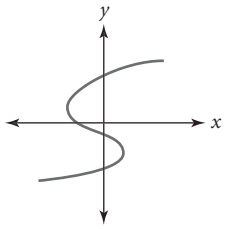
CHAPTER 7 • Quiz 1 — Form A

1. Answers will vary. Sample answers:

a.



b.



2. a. Yes; each person has a unique Social Security number.

b. No; a particular first name might be paired with many different last names; for example, Mary Smith, Mary Jones, Mary Wong, and so on.

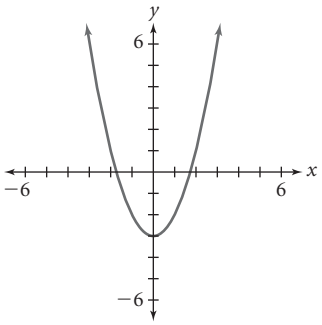
c. No; many cities have more than one Zip code.

d. Yes; each state has only one governor.

3. a.

x	−3	−2	−1	0	1	2	3
y	6	1	−2	−3	−2	1	6

b.



c. The relationship is a function; for each x-value, or input, there is exactly one y-value, or output.

d. The range is $-3 \leq y \leq 6$.

4. Check to see whether there is a vertical line that crosses the graph at more than one point. If there is, the graph does not represent a function.

5. No; in a vertical line, one x-value is paired with infinitely many y-values.

6. a. It is not a function because the input value 4 has two different output values, 1 and 0; domain: $\{-2, 0, 3, 4\}$; range: $\{-1, 0, 1, 3\}$.

b. It is a function because each input value has only one output value; domain: $\{-3, -1, 0, 1, 5\}$; range: $\{0, 2, 3, 8\}$.